Voszka, É. – Kiss, G. D. (eds) 2014: *Crisis Management and the Changing Role of the State.* University of Szeged Doctoral School in Economics, Szeged, pp. 169-178.

11. Related variety research in regional economic development[1]

Zoltán Elekes

Significant attention has been paid to the notions of relatedness, related variety and unrelated variety in regional economic development research. Facets of (technological) proximity are at the core of theorizing on the sectoral knowledge spillovers of related industries and on the portfolio effect of unrelated variety in the robustness of the regional economy. The utrecht school, a stronghold of such research agendas, has thematized the debate by formulating related variety research questions and by developing the entropy-based methodology. Connections to the evolutionary economic geography discussion have also been established by the utrecht line of inquiry. This paper highlights key aspects of the research on related variety. It is argued that a more explicit attention to policy issues would be beneficial moving forward. Also evolutionary economics can further contribute to the theoretical foundation of the related variety concept.

Keywords: related variety, unrelated variety, regional economic development, economic geography

1. Introduction

The notions of related and unrelated variety have gained an ever so increasing attention from economic geographers in the international scene. This attention mainly followed the seminal paper of Frenken et al. (2007), examining the relationship between related and unrelated variety of sectors in the regional economy and the economic and employment growth of said regions. According to Google Scholar, this paper accumulated 599 individual citations in the course of the last six years, including approximately 150 last year. The several peer-reviewed articles published recently and the amount of working papers building on variety show that it is a relevant topic of vivid regional scientific discourse. The theoretical point of departure in

[1] Present working paper is supported by the European Union and co-funded by the European Social Fund. Project title: "Preparation of the concerned sectors for educational and R&D activities related to the Hungarian ELI project." Project number: TÁMOP-4.1.1.C-12/1/KONV-2012-0005.

Frenken et al. (2007) is that of agglomeration externalities and the key contribution of their work is in the methodology, introducing entropy measures to account for related and unrelated variety. Research on variety conducted by others mainly follows this methodological focus.

In spite of the recent influx of variety-based research in the international economic geography scene, appearance of this topic in Hungarian regional scientific discussion is still scarce, perhaps with the exception of Lengyel and Szakálné (2013). Present paper sets out to review the relevant literature on related and unrelated variety and *to see whether the contribution of these notions to economic geography resulted in "knowledge accumulation"* as phrased by Henning et al. (2013). After the discussion of the next few pages, some points of interest will be identified, that may be the focus of future variety related research agendas.

The paper is structured as follows. The next section highlights key characteristics of the concept of variety, including agglomeration economies, relatedness and technological proximity. In the third section reoccurring themes in related variety research and research questions are discussed, like competitiveness focus and regional branching. The paper concludes by a summary and a set of possible extensions to related variety research for future research agendas.

2. The concept of (related) variety

The spatial concentration of economic activities is a key feature in regional microeconomics. Firms clustered in the same locality receive benefits of different sources called agglomeration economies or agglomeration externalities. Following the reasoning of Frenken et al. (2007), present discussion of related variety departs from agglomeration economies as well. Different forms of agglomeration economies have been identified in economic geography. (1) Internal increasing returns to scale, understood as production cost efficiency stemming from a large market size. It is internal for the firm and so not in the focus of present paper. (2) Localization economies (Marshallian externalities), understood as external economies available to all firms of the same sector of a locality. (3) Urbanization economies, understood as external economies available to all firms, stemming from urban size and density. (4) Jacobs externalities, understood as external economies available for all firms, stemming from the variety of sectors in a region.

The different sorts of agglomeration economies yield different benefits for firms and their region. Based on the likelihood and nature of knowledge spill overs occurring, localization economies contribute to incremental and process innovation through knowledge spillovers within sectors (Lengyel–Rechnitzer 2004). Jacobs ex-

ternalities yield knowledge spillovers between related sectors, resulting more likely in radical and product innovation. Urbanization economies facilitate interactive learning between firms and other institutions of the local society, including universities, local governance and NGOs. According to Frenken et al. (2007), related variety is understood as the source of Jacobs externalities, while unrelated variety sums up to a portfolio effect for the regional economy, making it more resistant against asymmetrical sectoral shocks (Table 1).

Table 1. Sectoral relatedness and external economies

Degree of variety	**Similarity**	**Related variety**	**Unrelated variety**
Agglomeration externality	Localization economies	Jacobs externalities	Urbanization economies
Relational proximity	High	Moderate	Low
Effect in the regional innovation system	Incremental innovation	Radical innovation	Institutional coevolution
Effect on the robustness of the regional economy	Exposure to asymmetric shocks	Exposure to asymmetric shocks	Resistance to asymmetric shocks

Source: Own construction

Hence the central issue of theorizing on related and unrelated variety – and in turn on the occurrence and intensity of knowledge spillovers – is the understanding of relatedness. That is, when and to what degree can it be stated that two firms or sectors are in fact related or unrelated. While a formal approach to this problem has been devised in the entropy measure, it is important to highlight the roots of relatedness in appreciative theory as well. Breschi et al. (2003) argued that technological relatedness is the result of the firms learning process – intentional, based on search processes and unintentional, based on knowledge spillovers – and the nature of knowledge as a resource. Studies from the management literature on business portfolio relatedness are interested in firm diversification of economic activities (e.g. Tang–Rowe 2012, Shin–Shin 2013). Cassiman et al. (2005) conducted research from an industrial organization theory point of view on merger and acquisition and built upon technological relatedness as a form of synergy stemming from existing production processes and knowledge recombination possibilities. Piscitello (2000) argued that industrial and market relatedness aside, the firms role in selecting what is related and what is not in terms of activity is a strong selection process and a formative element of industries.

The degree of relatedness between industries and thus the significance of agglomeration economies arising is a translation of the geographical, cognitive or otherwise proximity of said industries. On the one hand, proximity and embeddedness

facilitates knowledge spillovers. On the other hand, distance between firms can yield flexibility, creative solutions and emergence of variety (Boschma 2005, Frenken 2009, Boschma–Frenken 2010). In this sense, strong proximity may also result in lock-ins, while weak proximity makes coordination difficult and renders the firms creative processes more isolated. In terms of agglomeration externalities, the first case is localization externalities in extreme proximity situations (i.e. firms of the same industry in the same locality). The second case is related variety with a fertile soil for radical innovation and the emergence of new industries. Technological proximity is central notion in the conceptualization of relatedness. According to Knoben and Oerlemans (2006, p. 77.):

> *"[Technological proximity] refers […] to the knowledge actors possess about these technologies. Similarities in technological knowledge […] facilitate technological learning as well as the anticipation of technological developments…"*

Again, the central issue is the difference in knowledge between firms regardless of this knowledge being codified, appearing as machinery or other artefact or being tacit represented in organizational routines, as suggested by Nelson and Winter (1982).

Finally, some authors from the field of international trade theory have shown interest in related variety of industries as well. There, a connection between export basket diversification and economic development (e.g. growth) is established. The role of export basket diversification in development is identified as a source of knowledge spillovers and a platform of interactive learning (Kadochnikov–Fedyunina 2013).

3. Themes in related variety studies

The lively discourse in the literature on related variety indicates that the concept sheds light on the important effect of similarity and difference in the regional economy. First it helps understanding how the difference of industries can contribute to employment, economic growth and overall competitiveness, the common goals of regional economic development theory. Second it holds key insights to the evolution of the regional economy. The specialization and diversification of said economy through the emergence of new industries and the disappearance of old ones (i.e. Schumpeterian creative destruction) is a path-dependent branching process best understood in its own historic context.

3.1. Competitiveness-based approach

Regional competitiveness has been identified as the central tool for welfare in mainstream regional development literature. It is understood as a composition of the regions capabilities to maintain relatively high employment rate and relatively high income (Lengyel 2010). The concept of competitiveness is the bases for evaluating the effect of related variety on regional economic performance. Since related industries are identified as the sources of knowledge spillovers more likely to result in radical innovation, they are also beneficial for economic growth. Likewise the emergence of new industries provides additional opportunities for traded sectors to attract additional income.

In the mainstream literature it is widely agreed upon, that in the case of regions in developed economies, related variety is beneficial for employment. New industries provide additional demand for labour and the presence of related industries makes it less likely for firms to exit their industry. Frenken et al. (2007) added that unrelated variety serves as safety net against unemployment in case of an asymmetric sectoral shock (Table 2). In the case of a transitional economy setting, Lengyel and Szakálné (2013) showed that in lagging regions related variety aggravated the employment conditions of a region, most likely because it reinforces negative-lock in patterns.

Table 2. Effect of related variety on aspects of competitiveness

Study	**Employment**	**Growth**
Boschma et al. 2010	0	+
Boschma–Iammarino 2009	+	+
Frenken et al. 2007	+	0

Note: "+" indicates positive, significant impact, "0" indicates insignificant impact, "-" indicates negative, significant impact

Source: Adapted from Kadochnikov–Fedyunina (2013, p. 7.)

3.2. Regional specialization, diversification and regional branching

The related variety concept can serve as bases for understanding the diversification of the regional economy over time. As firms diversify into technologically related economic activities or new firms appear through entry or spin-off process, the composition of the regional economy changes. This is a path-dependent branching process in the sense that the growth of new industries is anchored by the existing portfolio of economic activities. Also the exit of existing firms is affected by their relatedness to dominant economic activities. The description of this branching process

has been begun in increasing detail (see for e.g. Boschma–Frenken 2009, Boschma–Iammarino 2009, Neffke et al. 2011, Boschma et al. 2012).

In these attempts of accounting for the underlying processes of regional economic branching, it is commonly agreed upon that the technological relatedness of firms and their respective industries is based on knowledge. This knowledge is represented in organizational routines on the firm level (Nelson–Winter 1982), in the products of the firm and in the employee know-how. As research into regional branching indicates, new industries emerging from radical innovation build upon these existing firm competences. This may help explaining why industries growing out of a radical innovation tend to cluster in previously successful regions (e.g. bio- or nanotechnology in informatics hubs or the YouTube content producing community in Los Angeles). The concept of knowledge bases can be interpreted as an attempt to organize the knowledge particularities underlying relatedness (Asheim et al. 2011). In this sense, the related variety concept is deeply embedded in theorizing on knowledge, interactive learning and innovation systems.

A recent development of the smart specialization concept in the economic geography literature builds heavily on the concept of relatedness and its relevant research. Smart specialization is a notion adapted for economic geography by McCann and Ortega-Argilés (2011) with an explicit regional development policy focus. Relatedness is one of the building blocks of their approach: diversifying into related industries serves the robustness of the regional economy as well as enhances the possibility of knowledge spillovers. The growth of the regional economy can be fostered by the technological diversification of its embedded industries. As McCann and Ortega-Argilés (2011, p. 16.) put it:

> *"[…] the most promising pathways forward for a region to promote its growth by enhancing its technological capacity are by diversifying into technologies which are closely related to the existing dominant technologies."*

4. Conclusions and ideas for further research

The analysis of relatedness and variety is a promising framework for understanding regional economic change. The emergence of new industries and the innovativeness of existing ones, the specialization or diversification of the regional economy and the path-dependent branching process of the industry portfolio are explananda approachable with the concept of relatedness. The effect of related industries on the economy so far seems to be positive on employment, growth and overall competi-

tiveness. This makes the notions of related and unrelated variety attractive for regional economic development theory.

4.1. Interpretation for regional economic development policy

For the most part, empirical evidence based on related variety is rarely accompanied by regional economic development policy implications. The policy distance of ongoing research projects reflects in part the relative novelty of the variety concept. In this sense caution exercised by researchers about policy messages is warranted. On the other hand policy distance – in part – comes from a distance from normative goals in regional economic development research. As phrased by Markusen (1999, p. 873.):

> *"…regional research should be policy-relevant and concerned not only with efficiency but also with normative goals loosely considered 'progressive': equity; democracy; human rights; environmentally benign development."*

Frenken et al. (2007) briefly mention that regional policy supporting related variety may decrease the risk of selecting wrong sectors for the bases of regional economic development, since it is focusing on existing competences. On the other hand, the reinforcement of the existing economic base of a region may in turn aggravate an existing negative lock-in situation. As Lengyel and Szakálné (2013) suggest, this may exactly be the case with lagging behind regions of transition economies. Also the emergence of new industries may not follow the policy interventions based on existing competences and related variety. Or new related industries may appear on their own relying on said competences, as suggested by the window of locational opportunity concept of Boschma (1997), without using policy resources at all. Thus the clarification of the role of related and unrelated variety in regional economic development policy seems to be an important focal point in future research on variety.

While competitiveness is a widely used baseline for evaluating economic performance, other approaches can be taken up by the policymaker. The detrimental effect of related variety in a region in negative lock-in situation shows, that even within in the competitiveness framework, further research on different regions is welcome. Likewise the evaluation of interactive learning and regional economic branching on the bases of related variety could be analysed from a different standpoint. For example evaluation of related variety based on environmental sustainability could investigate the self-reinforcing impact of economic activity and regional branching on the local environment or society.

4.2. Insights on variety from Generalized Darwinism

The appearance of the evolutionary approach in economic geography contributed to several fields of discussion, including cluster dynamics, evolution of regional knowledge networks and regional development through economic branching (Fedyunina et al. 2014). It can be argued that the related variety approach itself is a contribution rooted in the evolutionary economic geography discourse. The existence and source of variety is a central issue in evolutionary economics and a process to be explained. Variation is considered one of few principles essential in evolutionary reasoning (Hodgson–Knudsen 2006, Stoelhorst 2010). These principles work in tandem, as Metcalfe and Miles (1994, p. 253.) put it:

> *"Progress depends not on chaotic generation of variety, but on focusing devices which constrain the development of technology into channels which have already been found to be productive."*

Although it is widely agreed upon that variety is a key contributor to the success of a population – a region in the case of economic geography –, the scope of its significance and its meaning is still unclear. Essletzbichler and Rigby (2010) collected a couple of meanings associated with variety including the variety of organizational routines, product and process variety and heterogeneity generated by innovation. Based on the related variety research explored above, variety of knowledge generated through interactive learning and employee movement, or variety of industries in a region are also applicable approaches when analysing the success of a population (e.g. regional growth, regional development). Whether these sorts of variety have a common element (e.g. knowledge bases) or they are different, and cannot be regressed into a single notion of variety seems undecided at the moment.

References:

Asheim, B. T. – Boschma, R. – Cooke, P. (2011): Constructing regional advantage. Platform policies based on related variety and differentiated knowledge bases. *Regional Studies*, 45, 7, pp. 893-904.

Boschma, R. A. (1997): New industries and windows of locational opportunity. A long-term analysis of Belgium. *Erdkunde*, 51, 1, pp. 12-22.

Boschma, R. A. (2005): Proximity and Innovation: A Critical Assessment. *Regional Studies*, 39, 1, pp. 61-74.

Boschma, R. A. – Minondo, A. – Navarro, M. (2012): Related variety and regional growth in Spain. *Papers in Regional Science*, 91, 2, pp. 241-256.

Boschma, R. A. – Frenken, K. (2009): Technological relatedness and regional branching. *Papers in Evolutionary Economic Geography, Working Paper Series.* Downloaded on 6 February 2014. http://econ.geo.uu.nl/peeg/peeg.html.

Boschma, R. A. – Frenken, K. (2010): The spatial evolution of innovation networks: a proximity perspective. In Boschma, R. A. – Martin R. (eds): *The Handbook of Evolutionary Economic Geography*. Edward Elgar, Cheltenham–Northampton, pp. 120-135.

Boschma, R. A. – Iammarino, S. (2009): Related Variety, Trade Linkages, and Regional Growth in Italy. *Economic Geography*, 85, 3, pp. 289-311.

Breschi, S. – Lissoni, F. – Malerba, F. (2003): Knowledge-relatedness in firm technological diversification. *Research Policy*, 32, pp. 69-87.

Cassiman, B. – Colombo, M. G. – Garrone, P. (2005): The impact of M&A on the R&D process. An empirical analysis of the role of technological- and market-relatedness. *Research Policy*, 34, pp. 195-220.

Essletzbichler, J. – Rigby, D. L. (2010): Generalized Darwinism and evolutionary economic geography. In Boschma, R. A. – Martin R. (eds): *The Handbook of Evolutionary Economic Geography*. Edward Elgar, Cheltenham–Northampton, pp. 43-61.

Fedyunina, A. – Elekes Z. – Kálmán J. (2014): Evolutionary Economic Geography in Central and Eastern Europe. Conference report. *Acta Oeconomica*, 64, 1, pp. 108-112.

Frenken, K. (2009): Proximity, Social Capital and the Simon Model of Stochastic Growth. In Reggiani, A. – Nijkamp, P. (eds): *Complexity and Spatial Networks. In Search of Simplicity*. Springer-Verlag, Berlin–Heidelberg, pp. 133-140.

Frenken, K. – van Oort, F. – Verburg, T. (2007): Related Variety, Unrelated Variety and Regional Economic Growth. *Regional studies*, 41, 5, pp. 685-697.

Henning, M. – Stam, E. – Wenting, R. (2013): Path Dependence Research in Regional Economic Development: Cacophony or Knowledge Accumulation? *Regional Studies*, 47, 8, pp. 1348-1362.

Hodgson, G. M. – Knudsen, T. (2006): Why we need a generalized Darwinism, and why generalized Darwinism is not enough. *Journal of Economic Behavior & Organization*, 61, pp. 1-19.

Kadochnikov, S. – Fedyunina, A. (2013): Export diversification in the product space and regional growth: Evidence from Russia. *Papers in Evolutionary Economic Geography, Working Paper Series.* Downloaded on 6 February 2014. http://econ.geo.uu.nl/peeg/peeg.html.

Knoben, J. – Oerlemans, L. A. G. (2006): Proximity and inter-organizational collaboration: A literature review. *International Journal of Management Reviews*, 8, 2, pp. 71-89.

Lengyel B. – Szakálné K. I. (2013): Related variety and regional growth in Hungary: towards a transition economy approach. *Regional Statistics*, 3, pp. 98-116.

Lengyel I. (2010): *Regionális gazdaságfejlesztés*. Akadémiai, Budapest.

Lengyel I. – Rechnitzer J. (2004): *Regionális gazdaságtan*. Dialóg Campus, Budapest–Pécs.

Markusen, A. (1999): Fuzzy Concepts, Scanty Evidence, Policy Distance: The Case for Rigour and Policy Relevance in Critical Regional Studies. *Regional Studies*, 33, 9, pp. 869-884.

McCann, P. – Ortega-Argilés, R. (2011): Smart Specialisation, Regional Growth and Applications to EU Cohesion Policy. *Economic Geography Working Paper 2011*, Faculty of Spatial Sciences, University of Groningen. Downloaded on 6 February 2014. http://ipts.jrc.ec.europa.eu/docs/s3_mccann_ortega.pdf.

Metcalfe, J. S. – Miles, I. (1994): Standards, selection and variety: an evolutionary approach. *Information Economics and Policy*, 6, pp. 243-268.

Neffke, F. – Henning, M. – Boschma, R. A. (2011): How Do Regions Diversify over Time? Industry Relatedness and the Development of New Growth Paths in Regions. *Economic Geography*, 87, 3, pp. 237-265.

Nelson, R.R. – Winter, S.G. (1982): *An Evolutionary Theory of Economic Change.* The Belknap Press of the Harvard University, Cambridge, MA.

Piscitello, L. (2000): Relatedness and coherence in technological and product diversification of the world's largest firms. *Structural Change and Economic Dynamics*, 11, pp. 295-315.

Stoelhorst, J. W. (2010): The firm as a Darwin machine: How Generalized Darwinism can further the development of an evolutionary theory of economic growth. *Papers on Economics and Evolution*, *Working Paper Series.* Downloaded on 21 February 2014. http://ideas.repec.org/s/esi/evopap.html.

Shin, J. – Shin, H. (2013): Institutional ownership and technological relatedness: A test of endogeneity. *Journal of Business Research*, 66, pp. 2279-2286.

Tang, J. – Rowe, W. G. (2012): The liability of closeness: Business relatedness and foreign subsidiary performance. *Journal of World Business*, 47, pp. 288-296.